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LIQUID MANURE TANK SPREADERS

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INTRODUCTION

Handling manure as a liquid is an increasingly popular practice on Ontario farms. There are various ways of spreading this manure on the land, but the most common method is with a tank spreader.

When selecting and using spreading equipment, the farmer should keep in mind the end use of the manure. Used efficiently, manure can completely, or at least partly, replace commercial fertilizer needed for crop production. In order to use the manure efficiently, it's necessary to select equipment that will distribute it uniformly on (or in) the soil. Certain equipment characteristics will be discussed later.

The second thing the farmer should determine is the land application rate. This is expressed in either cubic metres per hectare or Imperial gallons per acre. The capacity of the spreader is usually known. To find the area of the field covered by each load, multiply length of spread pattern times width between successive loads. If these measurements are in metres, divide by 10,000 to get hectares. For measurements in feet, divide by 43,560 to get acres. Dividing "capacity of spreader" by "area covered per load" gives spreading rate.

The third step is to determine the nutrient analysis of the manure. The Ontario Ministry of Agriculture and Food offers a manure analysis service for a nominal fee. The manure test is advisable as there is a wide range of nutrient concentrations in the manure from different farms. Using the information gained here plus the spreading rate, the nutrients applied on a certain land area can be quickly calculated. The purchase and use of commercial fertilizer can then be adjusted accordingly.

TYPES OF EQUIPMENT

1. Vacuum Tank Spreaders

The vacuum tank systems consist of a sealed tank with a PTO powered air pump. This pump forces air either into or out of the tank, thus changing the air pressure inside the tank. To load, air is sucked out of the tank, creating a partial vacuum. Manure is, in turn, sucked into the spreader through a large diameter hose. Most spreaders can be loaded in two to four minutes. If agitation of the manure in the storage is needed, the pump can build pressure in the tank. Manure is forced out through the pipe to break up solids in the storage. Some systems enable the farmer to agitate the storage directly with compressed air and separate air hoses. These systems of agitation are limited to relatively small storages or easily agitated manure. For larger storages, or for beef or dairy manure, a separate agitator will likely be needed. Where a separate pump is being

used, perhaps to agitate the storage, it may be used to fill certain vacuum tank spreaders. Often, the spreaders have a hatch on the top that will facilitate this top-loading with a separate pump.

Most tanks have a method of indicating the level of manure inside the tank. One common device consists of a float inside the tank linked to a pointer on the outside. This is useful both when filling the tank and when spreading manure on the fields. The vacuum tanks also employ an automatic shut-off valve. This prevents the manure level from getting so high that it will be sucked through the air lines where it could damage the pump.

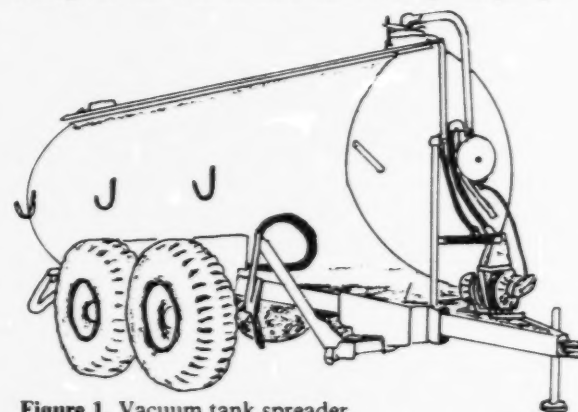


Figure 1. Vacuum tank spreader

Although vacuum tanks may be truck-mounted, the tractor-pulled spreader is the most popular. Table 1 gives some pertinent data relating to vacuum tank spreaders. It may be used as a guide when sizing spreaders to match tractor power levels.

Table 1. Selected Information for Tractor Pulled Liquid Manure Vacuum Tank-spreader

Capacity	Empty Weight		Time to Empty	Minimum Recommended Tractor Size*	
1 Imp. Gal.	kg	lb	min.	kW	hp
3000	660	1350	2.5	30	40
3800	840	1390	3.0	34	46
4200	920	1480	3.5	37	50
5700	1250	1980	4.0	45	60
8500	1870	2650	5.0	52	70
9800	2160	2800	5.5	60	80
12300	2700	3760	6.0	67	90
13600	3000	3920	6.8	75	100

*Without injection equipment

During transport to the field, the manure is often stabilized by baffles inside the spreader. These prevent sudden shifts of weight when stopping, starting, and on rough terrain. As well, several spreaders employ some method to agitate the manure during transport and spreading. This prevents settling of solids, which would otherwise lead to uneven spreading.

Once in the field, the pump is used to build air pressure in the tank, thus forcing the manure out. The manure may be forced against a deflector plate which fans it out into a wide spread pattern. Alternatively, the manure may be forced through drop pipes onto the soil surface, or through injectors directly into the soil.

Advantages of vacuum tank spreaders:

- relatively clean spreaders - less manure is spilled
- pump will need less maintenance since it only pumps air
- large suction hose permits large solids to pass
- in certain instances, vacuum unloading of the storage may be the only method possible

Disadvantages:

- agitation potential is limited in the manure storage - and when spreader is being used to agitate, turn around time per load is increased
- cost is greater than for same size of conventional top-loading spreader

2. Top-loading tank spreaders

The majority of liquid manure spreaders on Ontario farms fall into this category. The tanks are usually tractor-pulled although truck-mounted versions are also available. The tank is filled through an opening in the top. Usually a pump is used for filling but in some cases topography makes gravity loading feasible. The pumps used are of high capacity so that the loading may take only two or three minutes. A splash guard surrounds the opening to prevent splashed manure from running down the sides of the tank. The top-loading spreaders have methods similar to the vacuum tank spreaders for indicating the level of manure in the tank. Nevertheless, because of the high speed of filling, the tanks are sometimes filled to the point of overflowing. The loading area should be situated so that none of these minor spills poses any problems. A particular hazard exists when storages are located near streams.

Table 2. Selected Information for Tractor Pulled Liquid Manure Tank Spreaders (Top-loading)

Capacity	Empty Weight		Time to Empty	Minimum Recommended Tractor Size*		
1 Imp. Gal.	kg	lb	min.	kW	hp	
5700	1250	1730	3810	2.8	52	70
7950	1750	2100	4630	4.0	60	80
9800	2160	2430	5360	4.9	67	90
12300	2700	2840	6260	5.9	75	100
13600	3000	3250	7160	6.8	82	110
17400	3830	3790	8360	8.7	116	155

*Without injection equipment

Table 2 gives some pertinent data relating to top-loading manure tank spreaders. It gives recommended tractor sizes for different sizes of spreaders. During transport to the field, the top-loading spreaders may make use of the baffles and interior agitation described earlier for vacuum

spreaders. The unloading system is slightly different. There are two basic methods of emptying the spreaders, either by pumping or by gravity. The pump system employs an impeller at either the front or the rear of the spreader. Manure enters the impeller either by gravity or by auger in the spreader. From this point, several options are available. The impeller often forces the manure against a deflector plate giving a uniform spread pattern of a certain width. This spread pattern could be a wide band extending on either side of the line of travel. Alternatively, the pattern may be out to one side only. This is the case with all front-unloading systems and some rear-mounted systems.



Figure 2. Top-loading tank spreader with front-mounted injectors.

Farmers wanting to spread manure on standing row crops may prefer to use either drop pipes or injectors instead of broadcasting the manure onto the crop. A drop pipe system consists usually of two to four pipes which ride along just above ground level. These distribute the manure in strips between the rows. Injectors are basically the same except that the manure is knifed directly into the soil. Injectors may be mounted at either the front or rear of the spreader, while drop pipes are almost always mounted at the rear.

The gravity unloading spreaders rely on the weight of the manure to empty them. The fluid head at the outlet will gradually decrease as the spreader empties. Therefore, the rate of flow of manure will decrease accordingly. The manure may be deflected into a narrow band at the rear of the spreader, or it may be directed through drop pipes.

Advantages of top-loading tank spreaders:

- simpler operation than vacuum spreaders
- less cost than vacuum spreaders (not including the extra cost of a pump for filling)

Disadvantages:

- some method (usually a pump) needed for agitation of manure in storage and filling spreader
- greater chance of minor manure spills when loading

3. Other Equipment

Some liquid manure tank spreaders do not fall under either of the two headings already discussed. Two different concepts are worthy of mentioning here.

One design of tank is very similar to the top-loading

tank spreader except in the actual loading mechanism. One impeller is mounted at the rear of the spreader for loading and another is mounted at the front for unloading. The spreader is backed down a ramp into the liquid manure in the storage. The PTO powered impeller is lowered into the manure. When the PTO is engaged, the spreader begins to fill. One disadvantage to this system is related to the manure which tends to drip off the spreader and tires when pulled out of the storage. This fact may pose problems if the spreader has to be hauled past the farm house or along a roadway. Another disadvantage is that a special type of storage with a loading ramp is needed.

The desire by farmers to handle manure as a semi-solid has led to the design of some multipurpose spreaders. Some of these will handle any consistency of manure, while others will handle manure in semi-solid and liquid forms. These spreaders are usually of the open tank design with some kind of horizontal conveyor inside. The manure is moved by auger, for example, to either the front or the back. It is spread onto the land by a set of paddles, beaters, or an impeller. These spreaders have definite advantages in very thick slurries. Otherwise, farmers will likely find the cost is more than a tank spreader of the same volume.

INJECTORS

As mentioned earlier, injectors may be used with either vacuum tank spreaders or top-loading tank spreaders. There are two reasons why farmers choose to use injectors: to control odors and to preserve nutrients in the manure. Some farmers use them to spread manure on standing row crops. Injectors ensure that the manure is worked into the soil immediately. Different designs of injectors are available, varying from glorified cultivator teeth to wide shoes that create a cavity about 75 mm (3 in) below the soil surface. The actual injectors are mounted either on a tool bar or directly on the 3-point hitch of the tractor. If on a tool bar, they may be installed at either the front or rear of the spreader. When mounted at the front, the injectors are easily seen by the driver. It's possible to

achieve more uniform depth penetration on rolling land with the front-mounted injectors. Rear-mounted injectors have the advantage of breaking up the soil in the wheel tracks.

Use of injectors doesn't appreciably prolong the spreading time. However, more power is needed to pull the injectors through the soil. This is, of course, highly dependent on type of soil, depth of penetration, and number of injectors. The minimum tractor sizes in Tables 1 and 2 should be increased by about 11 kW (15 hp) when injectors are used.

SAFETY

Spreading liquid manure is not without its hazards. Consider the following safety reminders:

1. Never hold your head near the opening in a top-loading spreader as it is being filled. Manure gases are being displaced by manure and forced out through the opening.
2. Never stick your head into a spreader at any time. These same manure gases may be present and have led to at least one serious accident on an Ontario farm.
3. Liquid manure tank spreaders under about 13,000 l (3000 gal) normally do not have brakes. They could be dangerous on steep hills. A fully loaded 13,000 l spreader is almost twice the weight of a 75 KW (100 hp) tractor.

GENERAL

The changing needs of farmers are creating new challenges in the area of liquid manure spreading. Many farmers see the tank spreader as a culprit when it comes to soil compaction. Others are expanding their enterprises to the point where spreading manure with tank spreaders is a major job with high labor requirements. The odors emitted during spreading have brought pressures to bear on farmers in certain locations. On top of this, we have more and more farmers switching to liquid manure systems, for all types of livestock. At least in the foreseeable future, the tank spreader will be one of the most popular ways to spread liquid manure.